



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 9, 2022

Mr. David P. Rhoades
Senior Vice President
Constellation Energy Generation, LLC
President and Chief Nuclear Officer
Constellation Nuclear
4300 Winfield Road
Warrenville, IL 60555

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 – PROPOSED
ALTERNATIVE TO THE REQUIREMENTS OF THE ASME OM CODE
(EPID L-2022-LLR-0017)

Dear Mr. Rhoades:

By letter dated February 17, 2022 (Agencywide Documents Access and Management System Accession No. ML22048B569), Constellation Energy Generation, LLC, (the licensee) submitted an alternative request to the U.S. Nuclear Regulatory Commission (NRC) to the requirements of the American Society of Mechanical Engineers (ASME) Code for Operation and Maintenance of Nuclear Power Plants (OM Code), associated with valve inservice testing (IST) at Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities).

Specifically, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), part 50, section 55a, paragraph (z), subparagraph (1) (10 CFR 50.55a(z)(1)), to implement alternative request RV-08 for the frequency of the testing of certain safety relief valves at Quad Cities on the basis that the proposed alternative provides an acceptable level of quality and safety.

The NRC staff has reviewed the subject request and concludes, as set forth in the enclosed safety evaluation (SE), the proposal described in alternative request RV-08, to extend the required test interval for the safety relief valves listed in Table 1 of the enclosed SE, from 24 months to 48 months from the date of the as-left set pressure test will provide an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed the regulatory requirements set forth in 10 CFR 50.55a(z)(1) for alternative request RV-08. Therefore, the NRC staff authorizes the use of alternative request RV-08 for the sixth 10-year IST interval at Quad Cities, which is scheduled to start on February 18, 2023, and scheduled to end on February 17, 2033.

All other ASME OM Code requirements as incorporated by reference in 10 CFR 50.55a for which a relief or an alternative was not specifically requested, and granted or authorized (as appropriate), in the subject request remain applicable.

D. Rhoades

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If you have any questions, please contact the Project Manager, Robert Kuntz at 301-415-3733 or via e-mail at Robert.Kuntz@nrc.gov.

Sincerely,

Nancy L. Salgado, Chief
Plant Licensing Branch III
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-254 and 50-265

Enclosure: Safety Evaluation

cc: Listserv



UNITED STATES
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO

ALTERNATIVE REQUEST RV-08

CONSTELLATION ENERGY GENERATION, LLC

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-254 AND 50-265

1.0 INTRODUCTION

By a letter dated February 17, 2022 (Agencywide Documents and Access Management System (ADAMS) Accession No. ML22048B569) as supplemented by a letter dated June 30, 2022 (ML22181B096), Constellation Energy Generation LLC (Constellation, the licensee) submitted alternative request RV-08. The request was an alternative in lieu of specific inservice testing (IST) requirements in the 2017 Edition of the American Society of Mechanical Engineers (ASME) Operation and Maintenance of Nuclear Power Plants, Division 1, OM Code: Section IST (OM Code) during the sixth 10-year IST interval at Quad Cities Nuclear Power Station, Units 1 and 2 (Quad Cities).

Specifically, pursuant to subparagraph (1) in paragraph (z), "Alternatives to codes and standards requirements," of section 55a, "Codes and standards," in part 50, "Domestic Licensing of Production and Utilization Facilities," to Title 10, "Energy," of the *Code of Federal Regulations* (10 CFR 50.55a(z)(1)), the licensee requested to implement proposed alternative request RV-08 for certain safety relief valves (SRVs) at Quad Cities on the basis that the proposed alternative will provide an acceptable level of quality and safety.

The sixth 10-year IST interval at Quad Cities is scheduled to start on February 18, 2023 and scheduled to end on February 17, 2033.

2.0 REGULATORY EVALUATION

2.1 Regulatory Requirements

The U.S. Nuclear Regulatory Commission (NRC) regulations in 10 CFR 50.55a(f)(4), "Inservice testing standards requirement for operating units," state, in part, that throughout the service life of a boiling or pressurized water-cooled nuclear power facility, pumps and valves that are within the scope of the ASME OM Code must meet the IST requirements (except design and access provisions) set forth in the ASME OM Code and addenda that become effective subsequent to editions and addenda specified in 10 CFR 50.55a(f)(2) and (3) and that are incorporated by

reference in 10 CFR 50.55a(a)(1)(iv), to the extent practical within the limitations of design, geometry, and materials of construction of the components.

The NRC regulations in 10 CFR 50.55a(z), "Alternatives to codes and standards requirements," state that alternatives to the requirements of 10 CFR 50.55a(b) through (h) or portions thereof may be used when authorized by the Director, Office of Nuclear Reactor Regulation. A proposed alternative must be submitted and authorized prior to implementation. The applicant or licensee must demonstrate that:

- (1) *Acceptable level of quality and safety.* The proposed alternative would provide an acceptable level of quality and safety; or
- (2) *Hardship without a compensating increase in quality and safety.* Compliance with the specified requirements of this section would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

2.2 ASME OM Code Requirements

The applicable Code of Record for the sixth 10-year IST interval at Quad Cities is the 2017 Edition of ASME OM Code as incorporated by reference in 10 CFR 50.55a.

The IST requirements in the ASME OM Code, 2017 Edition, as incorporated by reference in 10 CFR 50.55a, related to this alternative request are as follows:

ASME OM Code, Division 1, Mandatory Appendix I, "Inservice Testing of Pressure Relief Devices in Water-Cooled Reactor Nuclear Power Plants," paragraph I-1320, "Test Frequencies, Class 1 Pressure Relief Valves," subparagraph (a), "5-Yr Test Interval," states:

Class 1 pressure relief valves shall be tested at least once every 5 yr [years], starting with initial electric power generation. No maximum limit is specified for the number of valves to be tested within each interval; however, a minimum of 20% of the valves from each valve group shall be tested within any 24-month interval. This 20% shall consist of valves that have not been tested during the current 5-yr interval if they exist. The test interval for any installed valve shall not exceed 5 yr. The 5-yr test interval shall begin from the date of the as-left set-pressure test for each valve.

3.0 TECHNICAL EVALUATION

3.1 Alternative Request RV-06

3.1.1 ASME Code Components Affected

The submittal proposed alternative testing for the SRVs listed in Table 1:

Table 1

Component	Description	Class	Category
1-0203-003A	MS-3A SRV (Target Rock)	1	C
2-0203-003A	MS-3A SRV (Target Rock)	1	C

3.1.2 Reason for Request

Quad Cities has one Target Rock 3-Stage, Model 74-67F, SRV installed on the main steam lines inside the drywell on each unit. Each SRV is classified in an IST program valve group of one for each reactor unit. ASME OM Code, appendix I, paragraph I-1320(a), requires that this SRV be assigned a 5-year test interval and tested every outage in order to comply with the requirement that at least 20 percent of the valves are tested every 24 months. Quad Cities are currently operating on 24-month refueling cycles. These SRVs at Quad Cities have shown reliable set-pressure performance.

The licensee conducted a performance assessment on the SRVs listed in Table 1 of this safety evaluation (SE) and asserts in the request that these SRVs will retain their set pressure within the required drift tolerances if the test interval is extended from 24 months to 48 months. Also, the request states that extending the test interval will reduce the occupational radiological dose that is incurred during the removal, testing, and reinstallation of these SRVs.

3.1.3 Licensee's Proposed Alternative and Basis for Use

The alternative proposed that the ASME OM Code, Appendix I, paragraph I-1320(a), required testing interval for the group of one for each SRV be extended from 24 months to 48 months from the date of the as-left set pressure test for each SRV.

The request stated that an SRV Best Practices Maintenance Program has been implemented at Quad Cities. The request stated that several enhancements have been made to the program since its implementation to improve SRV setpoint drift performance. The SRV best practices are developed from the application of the Electric Power Research Institute/Nuclear Maintenance Applications Center (EPRI/NMAC) Safety and Relief Valve Testing and Maintenance Guide and from Constellation (formerly Exelon) Operational Experience (OE). The SRV best practices have been implemented through the licensee's oversight of the valve vendor's test and rebuild processes. Major program elements include specific performance and inspection criteria and maintenance steps that exceed original equipment manufacturer (OEM) specifications and/or industry established guidelines. The main program elements include: (1) spring testing, (2) lapping techniques and tools, (3) set pressure adjustment methodology precision, (4) average delay time (adt) trending, and (5) internal component condition variations. The request described these elements in detail. For example, for the Target Rock 3-Stage SRVs, tighter tolerances are applied to the pilot abutment and preload gaps which reduce the likelihood of vibration-induced seat leakage caused by pressure transients. Collectively, the request stated that the use of these elements has supported an improved setpoint retention in SRVs at Quad Cities.

The letter dated June 30, 2022, stated that the Constellation best practices procedural guidance, ER-AA-400-1000, "Safety & Relief Valve (SRV) Testing, Tracking, and Trending," assigns the corporate SRV Program Engineer the following responsibilities:

- Develop, implement, and update the SRV program
- Maintain awareness of industry SRV issues
- Identify and investigate opportunities for program improvements
- Interface with EPRI, Safety Relief Valve Users Group (SRVUG) and Target Rock Users Group (TRUG)

Additionally, the applicable site SRV owner attends the annual SRVUG and TRUG meetings as a means of staying current with industry experience. These practices provide assurance that the latest industry experienced is identified, evaluated, and captured, as appropriate, in the Best Practices Maintenance Program.

The licensee recently performed an assessment pertaining to the performance of the Quad Cities Target Rock SRVs. The setpoint drift performance of the SRVs at Quad Cities has steadily improved by implementation of the enhanced maintenance program. This assessment reviewed as-left/as-found set pressure data back to 1998 and evaluated whether the SRV set pressure drifted up or down, and the absolute set pressure change between tests. Based on the time between the as-left and as-found set pressure test of each SRV, the set pressure drift was linearly extrapolated to determine whether the SRV set pressure would remain within the required ± 3.0 percent tolerance following a 48-month period. This assessment concluded that each SRV will retain the set pressure within the required drift tolerances after extending the test interval from the current 24-month interval to the proposed 48-month interval.

The request states that the improved SRV performance can be attributed to implementation of the SRV Best Practices Maintenance Program. The licensee will continue to disassemble and inspect each subject SRV following as-found set pressure testing to verify that parts are free of defects resulting from time-related degradation or service-induced wear. Each SRV shall be disassembled and inspected prior to as-left testing and installation in accordance with the SRV Best Practices Maintenance Program.

The request states that extending the test interval from 24 months to 48 months is acceptable based upon past performance and an evaluation that the Quad Cities Target Rock SRVs can maintain their setpoint within tolerance over a 48-month period. The request asserts that the proposed alternative to the SRV testing requirements will contribute to the principal of maintaining radiation dose as low as reasonably achievable (ALARA goals).

The request reports that using recent dose measurements associated with SRV removal and replacement at Quad Cities, the average radiological exposure incurred per SRV is about 0.54 rem. The request states that extending the SRV testing interval from 24 months to 48 months would allow testing of the SRV on each unit every other refueling outage (rather than every refueling outage). The request states that this would amount to a potential radiological exposure savings of approximately 2 rem of personal exposure at Quad Cities over the 10-year IST interval.

Since 2014, the licensee has been collecting, trending, and analyzing SRV test, maintenance, inspection, and performance data across its fleet of nuclear power plants. Trending and analyzing data between the nuclear power stations, which have the same SRV model, reduces the effective maximum elapsed time between tests for the same model SRV.

The June 30, 2022, stated that when an as-found set-pressure test result failure is discovered, the failure will be documented in the Constellation Corrective Action Program (CAP) and the requirements of ASME OM Code, Appendix I, paragraph I-1320(c), will be followed. Actions determined by the evaluation will be taken to address the failure. Returning the SRV to a 24-month test frequency may be implemented based on the failure and evaluation but would not be required under alternative request RV-08.

3.2 NRC Staff Evaluation

In lieu of the IST requirements in the 2017 Edition of the ASME OM Code, appendix I, paragraph I-1320(a), alternative request RV-08 proposes to extend the required test interval for the SRVs listed in Table 1 of this SE Quad Cities from 24 months to 48 months from the date of the as-left set pressure test for each SRV.

The alternative request stated that an SRV Best Practices Maintenance Program had been in place since 2010. The elements of the program include spring testing, lapping techniques and tools, set pressure adjustment methodology precision, average delay trending, and internal component condition variations. For the SRVs in Table 1 of this SE, tighter tolerances are applied to the pilot abutment and preload gaps, which reduce the likelihood of vibration-induced seat leakage caused by pressure transients. The time between the pilot valve opening and the main disk opening is measured and trended to determine if additional maintenance should be performed on the SRVs. The SRVs are also disassembled and inspected after as-found set pressure testing and before as-left set pressure testing. If any internal parts are found damaged, the licensee will replace those parts.

The alternative request stated that an assessment of the SRVs at Quad Cities was performed. This assessment reviewed as-left and as-found set pressure data since 1998. Based on the time between the as-left and as-found set pressure test for each SRV, the set pressure drift was linearly extrapolated to determine whether the SRV set pressure would remain within the ± 3.0 percent tolerance following a 48-month interval. Since 2014, eight SRVs at Quad Cities were removed and as-found tested, and were projected to have lift setpoints within the ± 3.0 percent tolerance for more than 48 months. The request stated that the setpoint drift performance of the SRVs at Quad Cities has improved as a result of the SRV Best Practices Maintenance Program. The request asserts that each SRV will retain the set pressure, within the required drift tolerances, throughout a 48-month interval.

The request stated that trending and analyzing test data between the nuclear power plants in the Constellation fleet that have the same SRV model reduce the effective maximum elapsed time between the same model tests. In a letter dated February 4, 2020 (ML20036D962) as supplemented by a letter dated June 12, 2020 (ML20164A188), the licensee requested to implement alternative request RV-08 for the remainder of the fifth 10-year IST program interval. The June 12, 2020, letter stated that the maximum time between SRV tests at the two Quad Cities units would be 36 months. The letter also stated that the licensee has been collecting, trending, and analyzing SRV test, maintenance, inspection and performance data since 2014 for Clinton Power Station, Unit No. 1, Dresden Nuclear Power Station, Units 2 and 3 (Dresden), Nine Mile Point Nuclear Station, Unit 2, Peach Bottom Atomic Power Station, Units 2 and 3 (Peach Bottom), Quad Cities, and Limerick Generating Station, Units 1 and 2. The licensee stated that Dresden, Peach Bottom, Quad Cities, and Limerick all use the same base model Target Rock SRVs. Like the NRC staff discussion in the SE dated January 14, 2021 (ML21005A061) for alternative request RV-08 during the previous 10-year IST interval, the NRC staff considers this information to support the sharing of information regarding the performance of the Target Rock SRVs during the sixth 10-year IST interval at Quad Cities.

In summary, alternative request RV-08 proposes the following for the SRVs listed in Table 1 of this SE at Quad Cities, Units 1 and 2:

1. Constellation will disassemble and inspect all SRVs prior to as-left testing and installation;

2. Constellation's SRV Best Practices Maintenance Program has been implemented for the SRVs affected by the proposed alternative;
3. Constellation's SRV Best Practices Fleet Engineering Program, which includes the sharing of applicable SRV test data between Constellation nuclear power plant units, will be established prior to implementation of this proposed alternative; and
4. The results of the as-left and as-found set pressure test data for the SRVs at Quad Cities within the scope of this request indicate that the SRV set pressures will remain within acceptable tolerance levels for more than 48 months.

Based on the licensee's SRV Best Practices Maintenance Program, the implementation of an SRV Best Practices Fleet Engineering Program to share applicable SRV test data between the licensee's nuclear power plants, and the results of the SRV as-left and as-found set pressure testing, the NRC staff finds that the proposal in alternative request RV-08 to extend the required test interval for the SRVs listed in Table 1 of this SE from 24 months to 48 months from the date of the as-left set pressure test provides an acceptable level of quality and safety in accordance with 10 CFR 50.55a(z)(1) for the sixth 10-year IST interval at Quad Cities.

4.0 CONCLUSION

As described above, the NRC staff finds that the proposal described in alternative request RV-08, to extend the required test interval for the SRVs listed in Table 1 of this SE from 24 months to 48 months from the date of the as-left set pressure test, will provide an acceptable level of quality and safety. Accordingly, the NRC staff concludes that the licensee has adequately addressed the regulatory requirements set forth in 10 CFR 50.55a(z)(1) for alternative request RV-08. Therefore, the NRC staff authorizes the use of alternative request RV-08 for the sixth 10-year IST interval at Quad Cities, which is scheduled to start on February 18, 2023, and scheduled to end on February 17, 2033.

All other ASME OM Code requirements as incorporated by reference in 10 CFR 50.55a for which relief or an alternative was not specifically requested, and granted or authorized (as appropriate), in the subject request remain applicable.

Principal Contributors: Gurjendra Bedi, NRR
 Thomas Scarbrough, NRR

Date: November 9, 2022

SUBJECT: QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2 – PROPOSED ALTERNATIVE TO THE REQUIREMENTS OF THE ASME OM CODE (EPID L-2022-LLR-0017) DATED NOVEMBER 9, 2022

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